Non-Equilibrium Plasma Dynamics Modeling of Xenon Clusters Irradiated by an Intense Laser Pulse

TZVETELINA PETROVA, KENNETH WHITNEY, Berkeley Research, Inc., GEORGE PETROV, JACK DAVIS, Naval Research Laboratory — Population inversions have been experimentally observed when small xenon clusters of 5-20 atoms are irradiated by ~230 fs high intensity laser of $10^{19}$ W/cm$^2$ and wavelength of 248 nm [1]. Consequently, a plasma channel ~1.5-2 cm in length and ~1.5–2 µm in diameter is formed which produces amplified x-ray emissions with gains ~20-60 for wavelengths in the range 2.71-3 Å. It has been conjectured [2], that population inversions in laser generated xenon plasmas may be efficiently created within M-shell ionization stages by photo- or collisional-ionization of 2s and 2p inner shell electrons. In this study we focus our attention on the influence of non-Maxwellian electron energy distributions on the collisional dynamics by which hollow atoms are generated in different ionization stages of xenon. These distributions are calculated from a relativistic molecular dynamics model.


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